

The COTS Dashboard: Adapting Business Intelligence to help protect the Great Barrier Reef*

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ABSTRACT

The Great Barrier Reef (GBR) is the largest coral reef ecosystem on the planet, hosting a haven of marine biodiversity and a food source for millions. Coral cover on the GBR has declined by approximately 50% over the last 30 years and increasing frequency and intensity of disturbances, exemplified by the recent mass bleaching events and continued outbreaks of the coral-eating Crown-of-thorns Starfish (COTS), suggests this pattern is likely to worsen. These declining trends and intensifying disturbances underpin an urgent need for effective and efficient management interventions to protect the GBR from further coral cover loss. Outbreaks of COTS have been responsible for 40% of the decline of coral cover on the GBR over the last 30 years and controlling them provides the only current solution to directly preserve coral cover on the GBR.

Since 2012, the Australian Government has funded a COTS Control Program to reduce the impact of this marine pest, currently consisting of two vessels performing targeted culling of COTS at strategically selected reefs of high ecological and economic value. The control program collects extensive ecological data, which is essential for monitoring the health of the Reef, developing and validating ecological models of the GBR and tracking progress of current intervention programs. In the context of recent mass bleaching and mortality of many corals on the GBR there has been an increased commitment to preserving coral cover and consequently the COTS Control Program is undergoing a three-fold increase in its operational fleet. The expansion of this program will provide unprecedented amounts of ecological data for the GBR (up to 7,000 surveys per annum across >700 reefs) and a unique opportunity to leverage these data using newly developed Business Intelligence (BI) software. Such initiatives provide managers with the interactive and user-friendly tools required to make adaptive data-driven decisions, ensuring the greatest strategic impact of conservation interventions.

Working closely with the Great Barrier Reef Marine Park Authority (GBRMPA), which administers the COTS Control Program, we have developed a data visualisation and analytical tool to increase the efficiency and efficacy of COTS Control Program. Built in Microsoft Power BI, "The COTS Dashboard" provides an interactive and user-friendly interface to synthesise data from a variety of disparate data streams and survey methodologies to provide easy to interpret visualisations and metrics of reef health to assess the status of the individual reefs and the progress of conservation interventions. Specifically, the Dashboard collates data collected by a range of organisations working on behalf of the Australian Government, including the Reef and Rainforest Research Centre (RRRC), the Association of Marine Park Tourism Operators (AMPTO), the joint Field Management Program (FMP) and the Queensland Parks and Wildlife Service (QPWS). Surveillance data used to define the severity and extent of COTS outbreaks is collected by these organisations in the form of broadscale manta-tow surveys (observer is towed around the perimeter of a reef) and fine scale Reef Health Impact Surveys (RHIS) (observations within a 5m radius of reef location). Surveillance data is also used to identify reefs and specific locations on reefs requiring targeted culling as well as to assess the effectiveness of control measures. Surveillance data is combined to form a weighted average to estimate COTS outbreak status for a reef (<0.11 COTS.Survey-1 = No Outbreak; <0.22 COTS.Survey-1 = Potential Outbreak; <1 COTS.Survey-1 = Established Outbreak; >1 COTS.Survey-1 = Severe Outbreak) as well as estimating hard coral cover. These estimates allow managers to assess the severity and extent of COTS outbreaks as well as the impact upon the coral community, at a local and regional scale (Figure 1).

* Online Presentation Link:

https://drive.google.com/file/d/1gAaEp_QcB39l53Fze9LvE-3Z-bj_nb65/view?usp=sharing

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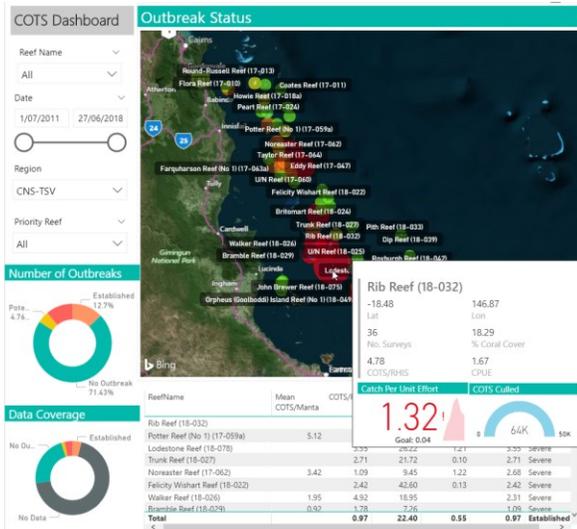


Figure 1. Example screenshot of the COTS Dashboard, highlighting how outbreak status is displayed with summary tooltips and the various temporal and spatial slicers available to the user.

The COTS Control Program also collects data relating to the number, size and location of COTS culled on the reef and then synthesized by the COTS Dashboard (Figure 2). The Control Program aims to cull starfish numbers to below established thresholds that promote coral recovery (0.04 COTS culled.min⁻¹). These data are visualized by the Dashboard, allowing managers to identify the success of the control program at a sub-reef, reef or regional scale as well as providing insight into the demography of the COTS populations over time. The COTS Dashboard also reports on Key Performance Indicators for the control program such as the reduction in COTS numbers, delivery of surveillance and monitoring data and the program’s effectiveness in reducing coral cover loss. Importantly, as the COTS Control Program is undergoing a three-fold expansion, the COTS dashboard provides a platform to synthesize these new data, and the deployment of a data capture app for new vessels will ensure quality data is provided to the COTS dashboard in near-real time.

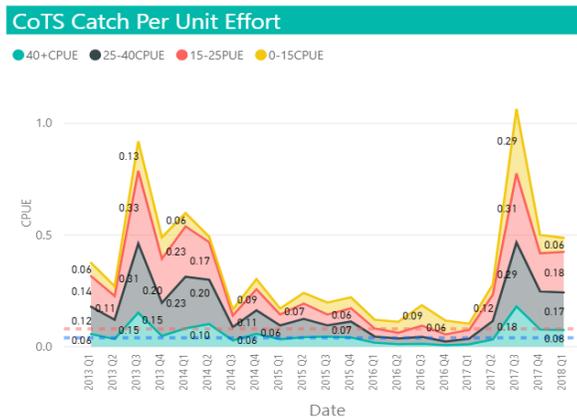


Figure 2. Example screenshot of the COTS Dashboard, displaying COTS catch per unit effort (CPUE) allowing managers to assess progress of the control program against the stated goal to reduce COTS numbers to below ecologically sustainable thresholds (dashed lines).

The COTS dashboard provides a novel application of the Business Intelligence framework to extensive ecological datasets, which have traditionally been reported on in a bi-annual cycle, limiting the flexibility of the control program to respond efficiently to changes in the system. The COTS Dashboard provides Reef managers and policy-makers with the most recent data on the current status and long term trends of COTS and coral cover for each of the > 700 reefs at which ever temporal/spatial resolution is required for the task at hand. Throughout the presentation we will highlight how the COTS Dashboard supports everyday decision making and reduces administrative burden for this multi-million dollar control program, by providing up to date, accurate and insightful data in the tight timeframes required by management, helping to achieve conservation goals.

In a broader context, the adaptation of BI tools and infrastructure to the conservation world provides a great opportunity to elevate conservation science and management into the big data era, not only on the GBR but also globally. These tools allow managers and policy-makers to leverage the power of their data and disseminate knowledge to a range of audiences, increasing the efficiency and efficacy of conservation interventions and promote the discovery of knowledge through data. Adapting BI infrastructure to conservation promotes the adaptive management of conservation problems, allowing managers to evaluate and adapt interventions in response to the rapidly changing environment. Successfully leveraging extensive ecological datasets with the user-friendly interactivity and modelling power of BI software could prove transformative to conservation, elevating the data literacy of natural resource managers and policy-makers, embedding data driven decision-making within institutions and ultimately promoting positive conservation outcomes.

CCS CONCEPTS

- Human computer interaction (HCI)
- Life and Medical Sciences
- Visualization
- Data Management Systems

KEYWORDS

Business Intelligence, Data visualization, Adaptive management, Conservation, Coral reefs, Great Barrier Reef, Crown-of-thorns Starfish

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